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April 4, 2011

Waste Management of Hawaii
Waimanalo Gulch Sanitary Landfill
92-460 Farrington Highway
Kapolei, Hawai'i 96707

Attention: Mr. Joe Whelan

Subject: Liner Damage Assessment, Repair, and Construction Quality Assurance Report for Cell E6 Sideslope, Waimanalo Gulch Sanitary Landfill, Kapolei, HI

Dear Mr. Whelan:

1.0 INTRODUCTION

This letter report presents a liner damage assessment and construction quality assurance (CQA) documentation of liner repair recently completed for the municipal solid waste (MSW) Cell E6 at the Waimanalo Gulch Sanitary Landfill (WGSL) at 92-460 Farrington Highway in Kapolei, Hawai'i. A series of storm events occurring in late December 2010 through mid-January 2011 resulted in high surface runoff flows that flooded MSW Cell E6 and damaged portions of the liner system.

2.0 DAMAGE ASSESSMENT

In late December 2010, a series of storms produced high run-on at the site resulting in damage to the northeastern edge of the MSW Cell E6 liner where it joins with Cell E4. Another large storm arrived on the evening of January 12, 2011 that resulted in additional flooding of the landfill and damaged the exposed portion of the western sideslope area of the MSW Cell E6 liner system. The damaged areas and repairs completed to date are shown on Figure 1, Attachment 1.

This letter report focuses on repairs to the northern half of the northern damaged area of the Cell E6 liner sideslope (see Figure 1), along the western edge of Cell E6. Repairs to the southern half of the northern sideslope area were documented in a previous letter report dated April 1, 2011. The activities described in this letter report complete the repairs to the Cell E6 liner that was damaged by the storm events. This Liner Damage Assessment, Repair, and Construction Quality Assurance Report follows requirements established in the *Workplan for Liner Evaluation and Repair* prepared by Geosyntec Consultants, Inc. dated January 27, 2011.

The high water flows during the storm events resulted in erosion of the operations layer soils on the termination bench and sideslope areas, thereby exposing the liner to subsequent damage by falling rocks. Additionally, the lack of anchor soil on the termination bench over the liner resulted in movement of the liner that created wrinkles. Due to numerous holes in the exposed sideslope liner at the northern end of the cell caused by falling rocks, water and sediment were able to flow between the geotextile, 60-mil high density polyethylene (HDPE) geomembrane, and geosynthetic clay liner (GCL) layers. Portions of the GCL of the

sideslope area were hydrated and covered with sediment due to the water and sediment flow.

Work began on March 31, 2011 to repair the northern portion section of the sideslope liner that contained hydrated GCL and damaged geomembrane. Repairs were completed on April 1, 2011. An excavator and hand labor were used to carefully remove any MSW, operations layer, and sediment off of the liner system so it could be inspected. Inspection holes were cut through the multiple layers of the liner system to determine if the GCL had been hydrated and where sediment had been deposited. This uncovering process continued until all damaged areas were exposed in the middle area of the sideslope. For this damaged area, all three layers of the single composite liner (40-mil HDPE geomembrane, GCL, and 60-mil HDPE geomembrane) required repair.

Following removal of damaged liner material, any repairs to the subgrade were completed prior to replacing the liner system components with new material. Details of the repair activities and CQA observations are presented in Section 3.0.

3.0 CONSTRUCTION QUALITY ASSURANCE ACTIVITIES

The participants in the Cell E6 repairs at WGSL and their respective roles are noted below:

- General Contractor: Goodfellow Brothers Inc.
- Geosynthetic Materials Repair Contractor: American Environmental Group, Ltd. (AEG)
- CQA Observation: AECOM Technical Services, Inc. (AECOM)
- CQA Geosynthetic Laboratory: Precision Geosynthetics Laboratory (Precision)

AECOM's CQA officer/project manager performed oversight for the documentation procedure including both fieldwork and report preparation. The CQA officer also prepared the documentation report and provided the engineering certification. The CQA officer's statement is included in Attachment 3. All repair work was performed in accordance with the following documents prepared by Geosyntec Consultants, Inc:

- *Technical Specifications and Construction Drawings, Cells E5 through E8, Waimanalo Gulch Landfill, Ewa Beach, O'ahu, Hawai'i*, dated January 2010 with revisions dated February 11, March 11, and March 16, 2010.
- *Waimanalo Gulch Landfill, Workplan for Liner Evaluation and Repair*, dated January 27, 2011.

Details of the CQA performed on the original MSW E6 construction can be found in:

- *Construction Quality Assurance Report for Cell E6 (Partial), Waimanalo Gulch Sanitary Landfill, Kapolei, Oahu, Hawaii* (AECOM, October 2010)

3.1 SUBGRADE PREPARATION

Minor damage to the subgrade was observed in the northern repair area. Damage to the subgrade included depressions from falling rocks and deposition of sediment. Any oversized

material was removed with an excavator or hand labor, prior to placement of 3/8 inch minus soil cushion material. Soil cushion material was placed to fill in shallow depressions or irregularities in the subgrade. A subgrade acceptance form was completed as required by the project specifications and is presented in Attachment 5.

3.2 GEOSYNTHETIC MATERIALS

Geosynthetic materials used to repair the liners were obtained from the stockpile of remaining material used for the Cell E6 (Partial) construction. Manufacturer's quality control documentation, conformance testing, and interface friction results for the materials were presented in the aforementioned original E6 CQA report.

3.3 TRIAL WELDS

Trial weld samples were produced several times during each day's production seaming. The seams were made by AEG technicians on representative pieces of the geomembrane to monitor each seaming apparatus and operator under the daily site conditions. At a minimum, trial welds were performed once in the morning and again during early afternoon. The trial seams were observed, monitored, and documented by AECOM.

Trial weld samples were a minimum of 5-foot (ft)-long by 1-ft-wide after seaming, with the seam centered lengthwise. Two specimens, measuring 1-inch-wide, were die-cut from each trial seam. The specimens were tested by AEG, for peel adhesion and bonded seam strength (shear strength) using an onsite tensiometer supplied by AEG. The tensiometer certification is presented in Attachment 6.

For the 40-mil geomembrane, the specified strength criteria for peel adhesion were 60 pounds per inch (ppi) for fusion welds and 52 ppi for extrusion welds. The specified strength criteria for all shear specimens (fusion and extrusion) were 80 ppi. For the 60-mil geomembrane, the specified strength criteria for peel adhesion were 91 ppi for fusion welds and 78 ppi for extrusion welds. The specified strength criteria for all shear specimens (fusion and extrusion) were 120 ppi. In addition to the strength criteria, all specimens were required to fail outside of the weld area in a film tear bond.

Production seaming was conducted after passing results on trial welds were achieved. Each trial seam was assigned a number, and pertinent information was recorded by AECOM. The summary of the trial weld seam results is presented in Attachment 7.

3.4 GEOMEMBRANE REPAIRS

The repair areas and repair locations are shown on Figure 2 through Figure 3 in Attachment 1. The northern portion of the northern repair area is along the sideslope area of Cell E6, corresponding to originally installed panels P-8 through P-15 (60-mil panel numbers), and is approximately 170-ft long in the north-south direction and 40-ft wide in the east-west direction. Both the upper 60-mil HDPE geomembrane and lower 40-mil HDPE geomembrane layers were completely replaced in the northern area. Repairs to the geomembrane were made at locations where the liner was physically damaged during the storm events, in addition to areas cut to remove wrinkles, sediment, or hydrated GCL.

During geomembrane installation, welding was performed using either the fusion or extrusion method. Upon completion of welding, each seam was tested for integrity and

continuity using non-destructive and destructive test methods described in Sections 3.6 and 3.7, respectively.

The extrusion welding procedure was used primarily for long cuts made in the geomembrane to remove wrinkles and the encapsulating weld. Also, extrusion seams were made at repair locations and other locations where fusion welding could not be performed. Fusion welding was used to join large repair panels. A more detailed description of each of the welding methods is presented in the following paragraphs.

Fusion Welding. To produce a fusion-welded seam, an AEG technician first prepared the surfaces to be welded by wiping the geomembrane panel edges clean and trimming excess overlap. The edges of the two panels were then placed into the welding machine. Two "hot-wedges" heated the geomembrane surfaces of both panels to molten material. The melted surfaces of the top and bottom layers of the overlap were then compressed by the drive rollers of the welding machine. In this way, the welding machine produced two parallel fusion welds, or "tracks," with a small air channel between them. The air channel was used for non-destructive continuity testing of the fusion weld, as discussed in Section 3.6.

AEG seaming technicians continually monitored the seaming operations and adjusted settings on the welding machine as necessary.

Extrusion Welding. To produce an extrusion weld, two pieces of geomembrane were temporarily tack welded together with a heat gun. Once tacked together, the edges of the two-geomembrane surfaces were then ground to provide a clean rough surface on which to place the extrusion weld. A technician then used a semi-automatic hand-held extrusion welding machine to produce the extrusion seam.

AEG seaming technicians continually monitored the seaming operations and adjusted settings on the extrusion welder as necessary.

The repairs were documented by recording the date repaired, location, description of damage, size and type of repair, crew that made the repair, date, and technician that conducted the non-destructive test on the repair.

Dates, locations, dimensions, and testing of seaming and repairs to the geomembranes are presented in the Panel Seaming Summary and Geomembrane Repair Summary in Attachment 7. Photos of the repair activities are included in Attachment 2.

3.5 GEOMEMBRANE SEAMING

AECOM observed and documented seam preparation such as sufficient sheet overlap; absence of dirt, dust, and moisture; and proper grinding techniques (for extrusion welding). The CQA staff also monitored the following during seaming: ambient temperature, panel overlap, welding machine temperature and speed, and conformance with trial weld parameters.

Seams were identified by the CQA staff using the panel numbers joined by the seam. For example, seam number RP-1/RP-2 is located between panel numbers RP-1 and RP-2.

The entire length of each seam was visually examined for quality. Imperfections in the seam were either marked by AECOM or AEG and were subsequently repaired by AEG. Additionally, the quality control (QC) technician from AEG occasionally removed a test strip from the production seams and tested the strip in the field using the tensiometer.

A total of 1,197 ft of geomembrane seams were welded for this portion of the repair area. Details of the panel seams are provided on the Panel Seaming Summaries in Attachment 7.

3.6 SEAM NON-DESTRUCTIVE TESTING

All geomembrane seams were non-destructively tested. Fusion welded seams were air pressure tested, and extrusion welds were vacuum box tested. AEG performed all non-destructive testing. AECOM CQA personnel observed non-destructive testing procedures and documented test location, test information, identity of AEG seaming technician, and the test results. Non-destructive seam testing information is provided in Attachment 7.

To begin air pressure testing of a fusion weld, the air channel between the two "tracks" of the fusion was heat sealed on both ends of the seam to provide a completely closed air chamber along the length of the seam. Next, a hollow needle, fitted into a pressure gauge, was inserted into the air chamber. The air in the channel was pumped to a pressure between 30 and 35 pounds per square inch (psi) and the pressure in the channel was allowed to stabilize for 2 minutes. After stabilizing, the beginning pressure was recorded and the seam was tested for at least 5 minutes. If the pressure dropped more than 2 psi during the 5-minute test, the seam was considered to have failed the test.

At the end of the 5-minute test period, the AEG technician walked to the end of the seam opposite from the pressure gauge and pierced the air channel. AECOM CQA personnel observed the needle on the pressure gauge drop. A drop in pressure indicated that the air channel had not been blocked and the entire seam had been tested. If the air pressure did not drop, the blockage in the air channel was located and marked for repair, and air testing was conducted on both sides of the blockage.

If a seam failed air pressure testing, the area where the needle was inserted into the air channel was checked for leaks. Next the heat-sealed ends of the seam were checked for leaks. If no air was found to be leaking at these locations, the AEG technician performed a visual inspection of the seam. If the leak was located visually, the seam was cut on either side of the leak, the air channel was heat sealed between the "tracks," and the seam was retested in both directions. If the retest failed, or the leak was not found visually, the seam was either capped by extrusion welding a 1- to 2-ft-wide piece of geomembrane over the failed seam or reconstructing the seam. All repaired seams were non-destructively tested using the vacuum box method.

Upon completion of air pressure testing, repairs were made to the areas where needles had been inserted, air channels had been pierced, and blockages or leaks had been identified.

Extrusion welds were non-destructively tested using a vacuum box. The vacuum box is an 8-inch by 24-inch cast aluminum frame fitted with a clear plastic viewing window and a neoprene rubber seal. A pressure gauge is mounted inside the box.

The test procedure involved applying a soapy solution to the weld. The vacuum box was then placed over the weld and a negative pressure of 5 psi was developed in the box. This test pressure was held on the weld for a minimum of 10 seconds. If there was a leak in the weld, the vacuum would draw air from under the liner and through the leak, and bubbles would develop in the soapy solution and be visible through the viewing window. If no air bubbles appeared, the weld section being tested was considered to have passed.

Vacuum box testing was performed with a minimum overlap of 3 inches between tests as the vacuum box was moved along the seam length. Results for the vacuum box testing of each extrusion repair and extrusion seam are summarized in the Geomembrane Repair Summary and the Non-Destructive Seam Testing Summary forms in Attachment 7.

3.7 SEAM STRENGTH DESTRUCTIVE TESTING

Two destructive test samples were obtained from the 1,197 ft of geomembrane seams installed during the repairs to the northern portion of the northern repair area. Samples were submitted to Precision for laboratory seam strength testing, resulting in a testing frequency of 1 test per 599 ft, which is slightly under the project specifications of 1 test per 500 ft of seam length. However a total of 2,534 ft of geomembrane seams were installed during the repairs of the entire northern and southern repair areas combined, with 6 total destructive test samples collected resulting in a testing frequency of 1 test per 422 ft.

The destructive samples where first tested in the field by AEG's QC representative with a portable tensiometer. The calibration certificate for the tensiometer is included in Attachment 6. Test strips were cut from the destructive sample and tested for peel adhesion and shear strength. Once the field strips passed, a portion of the remaining destructive test sample was sent to the geosynthetics laboratory for testing. The laboratory sample was subsequently cut into ten 1-inch-wide test specimens using a hydraulic press equipped with a 1-inch by 10-inch die. Five specimens were tested for shear strength and five for peel adhesion. In accordance with specifications, peel testing was conducted on both tracks of the weld. The testing was conducted at a constant rate of elongation of 2-inches per minute. The yield load and the mode of failure for each specimen were recorded.

The acceptance criterion for 40-mil shear specimens was that 4 out of 5 specimens have yield strengths of 80 ppi or greater and that failure should not occur in the weld. The acceptance criterion for peel specimens was that 4 out of 5 specimens have yield strengths equal to or exceeding 52 and 60 ppi for extrusion and fusion seams, respectively, and that failure should not occur in the weld.

The acceptance criterion for 60-mil shear specimens was that 4 out of 5 specimens have yield strengths of 120 ppi or greater and that failure should not occur in the weld. The acceptance criterion for peel specimens was that 4 out of 5 specimens have yield strengths equal to or exceeding 78 and 91 ppi for extrusion and fusion seams, respectively, and that failure should not occur in the weld.

The Destructive Seam Summary and laboratory data sheets and for the destructive test samples are presented in Attachment 7. The destructive samples met the requirements outlined in the project Technical Specifications (Geosyntec 2010) and the *Workplan for Liner Evaluation and Repair* (Geosyntec 2011).

3.8 GCL REPAIRS

Hydrated or otherwise damaged GCL was replaced in the designated repair areas beneath the 60-mil HDPE geomembrane as shown on Figure 2 and Figure 3. The GCL was deployed in a manner not to entrap stones or other loose soil under the material. All adjacent panels of new GCL were overlapped a minimum of 18 inches and bentonite was applied at a rate of 1/4 pound per ft of seam. As it was necessary to remove hydrated GCL on the sideslopes, horizontal seams on the sideslope were required to complete the repairs. Request for Information (RFI) Number (No.) 26, approved the use of horizontal seams on slopes steeper than 10 horizontal to 1 vertical and required an overlap of 5 ft and gluing with 3M Super 77 glue. A copy of the RFI is included in Attachment 8. Horizontal seams installed during the repairs were completed in accordance with RFI No. 26.

3.9 CUSHION GEOTEXTILE REPAIRS

Following completion of the geomembrane and GCL repairs, the 16-ounce/square yard (oz/yd^2) cushion layer geotextile was repaired using patches of new material, which were sewn using a double-stitched "prayer" style seam.

3.10 OPERATIONS LAYER

Following deployment of the geotextile, the operations layer was placed over the repair area. The operations layer consisted of onsite crushed/screened sand material and placed in a 2-ft-thick (minimum) layer over the cushion geotextile.

4.0 CONCLUSIONS

AECOM performed field observations and documentation of Cell E6 Repairs at WGSL as shown on Figure 1 through Figure 3. In summary, based upon our observations and test results, AECOM concludes that the work represented by the attached documentation is in substantial conformance with the original construction contract documents and their design intent, the *Workplan for Liner Evaluation and Repair* (Geosyntec 2011), and industry standard construction practices.

The activities described in this letter report complete the repair of the damaged areas to the Cell E6 liner system resulting from the December 2010 and January 2011 storm events.

If you have any questions or need more information about this project please call me at (808) 356-5321.

Sincerely yours,

Ronald E. Boyle, P.E.
Project Manager/CQA Officer
AECOM Technical Services, Inc.

Attachments:

1 Figures
2 Photo Log
3 CQA Officer's Statement
4 Daily Reports
5 Subgrade Acceptance Form
6 Tensiometer Certificate
7 Geomembrane Installation Documentation
8 Field Revisions

cc: Jesse Frey, Waste Management of Hawaii

Attachment 1
Figures

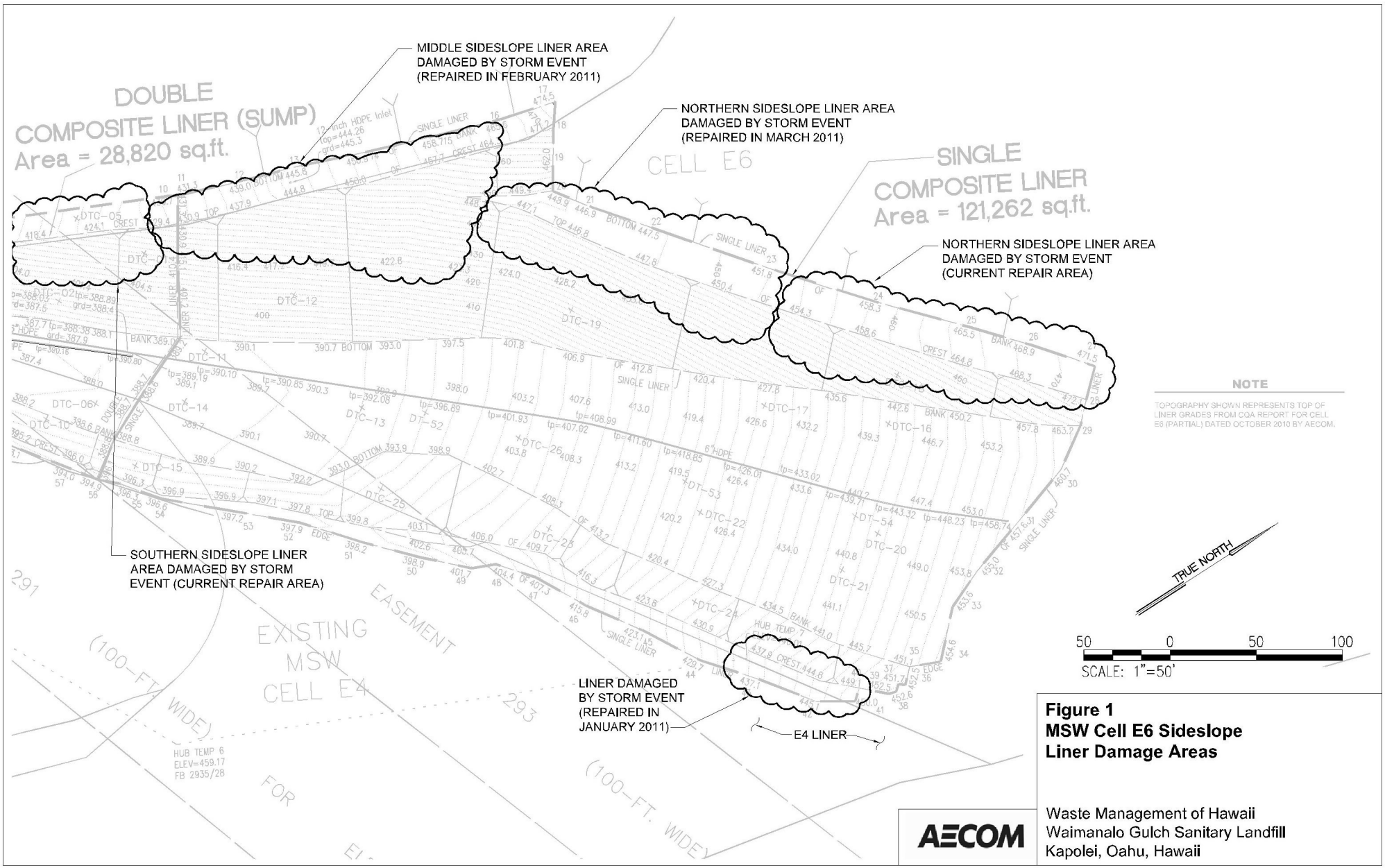

Figure 1
MSW Cell E6 Sideslope Liner Damage Areas

Waste Management of Hawaii
Waimanalo Gulch Sanitary Landfill
Kapolei, Oahu, Hawaii

AECOM

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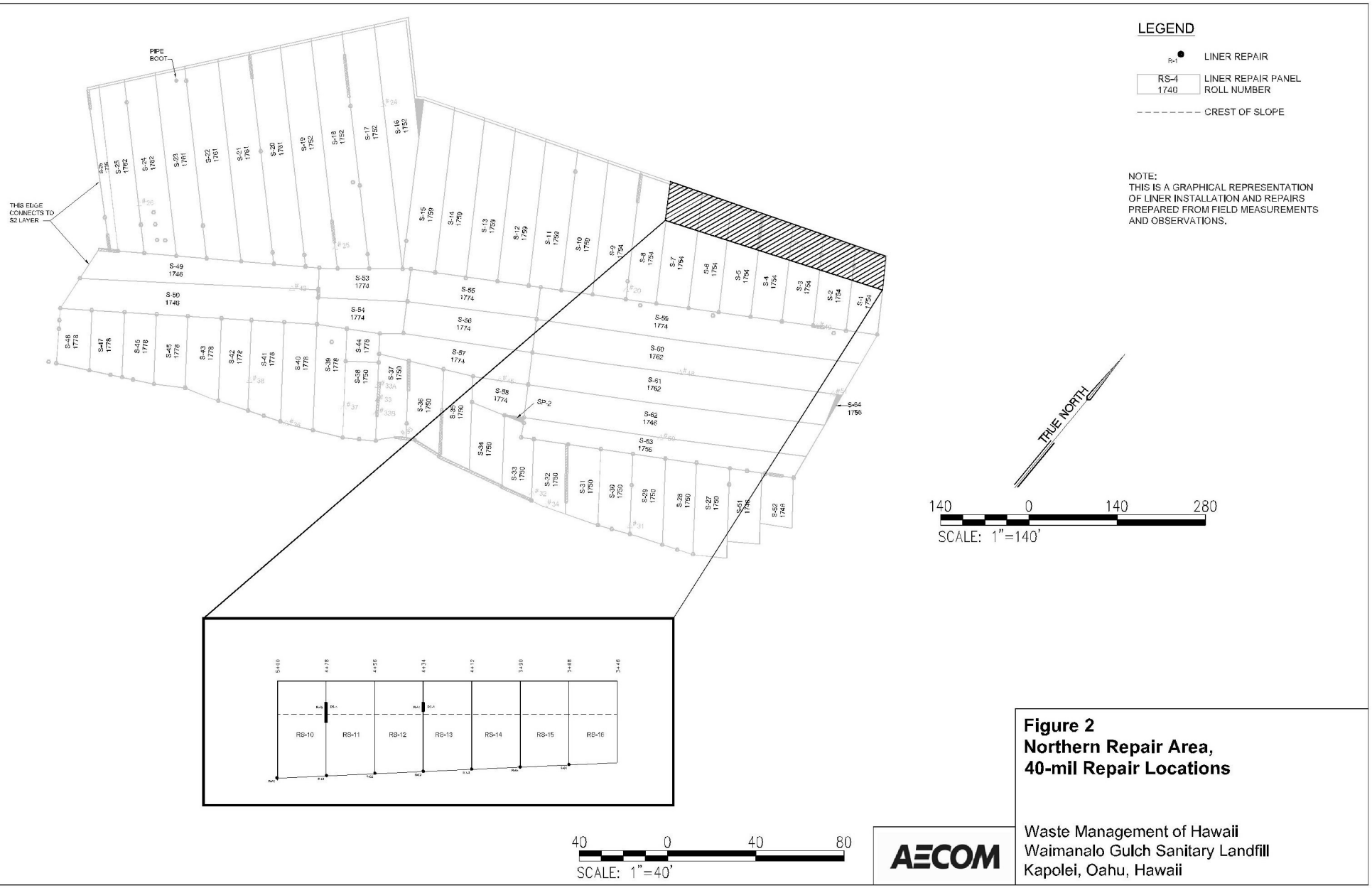


Figure 2
Northern Repair Area,
40-mil Repair Locations

Waste Management of Hawaii
Waimanalo Gulch Sanitary Landfill
Kapolei, Oahu, Hawaii

AECOM

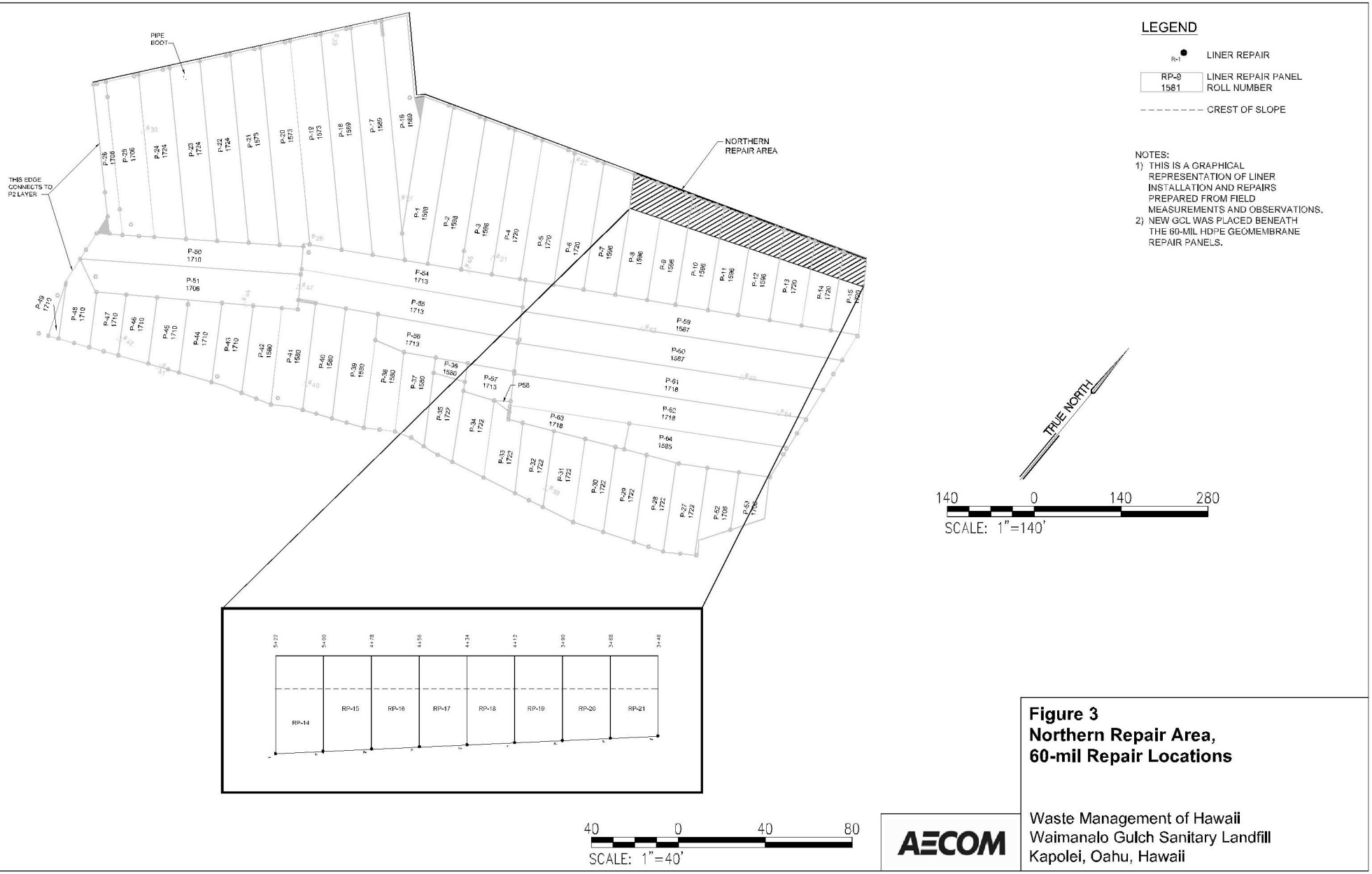


Figure 3
Northern Repair Area,
60-mil Repair Locations

Waste Management of Hawaii
Waimanalo Gulch Sanitary Landfill
Kapolei, Oahu, Hawaii

AECOM

Attachment 2
Photo Log

Photo 1: Excavator preparing subgrade of the northern portion of the northern repair area, looking north.

Photo 2: Excavating MSW to expose the northern portion of the northern repair area, looking north.

Photo 3: Northern portion of the northern repair area prior to deployment of 40-mil geomembrane.

Photo 4: 40-mil geomembrane repair panels on the northern portion of the northern repair area, looking south.

Photo 5: Extrusion welding the 40-mil geomembrane repair panel tie-in to the existing E6 liner system.

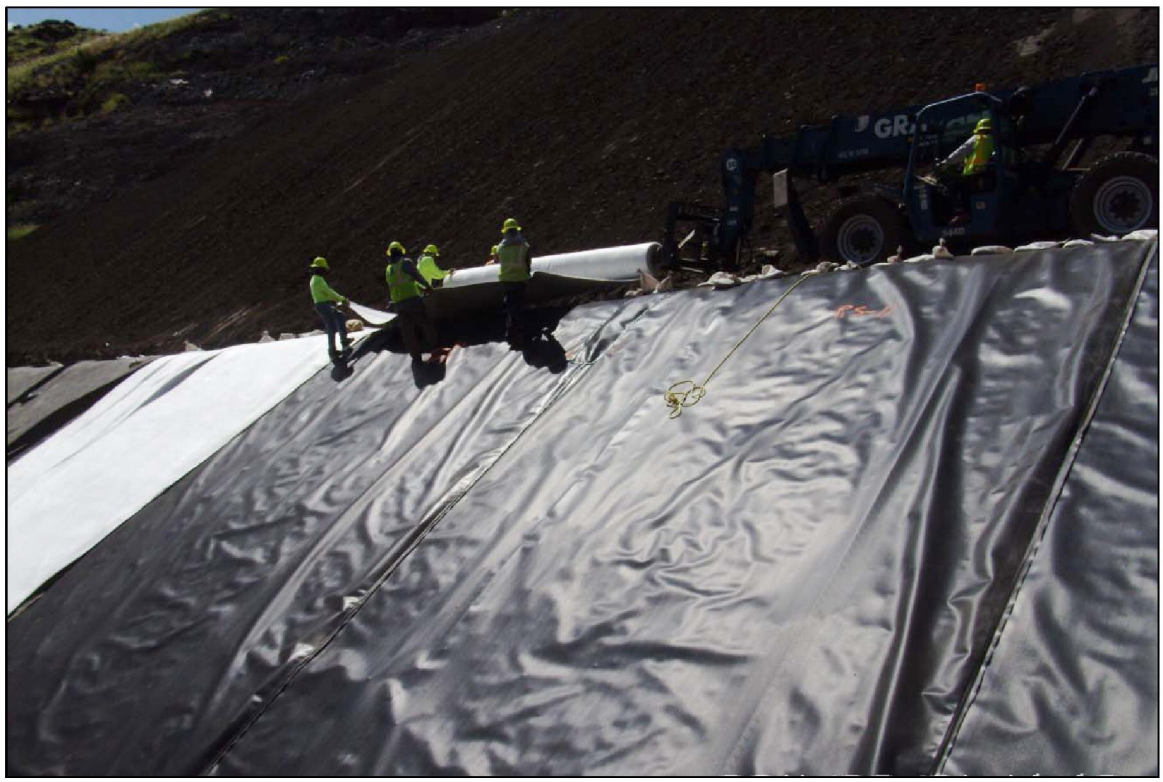


Photo 6: Deploying GCL over the 40-mil geomembrane repair panels on the northern portion of the northern repair area.

Photo 7: 60-mil geomembrane repair panels on the northern portion of the northern repair area, looking south. .

Photo 8: Encapsulated weld along the northern edge of the E6 liner system following installation of repair panels.

Photo 9: Deploying 16-oz geotextile over the repair panels on the northern portion of the northern repair area, looking southwest.

Photo 10: Operations layers on the northern portion of the northern repair area, looking north.

Attachment 3
CQA Officer's Statement

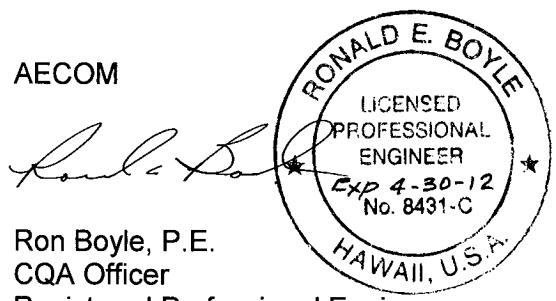
CQA OFFICER'S STATEMENT

The quality assurance consultant for MSW Cell E6 Sideslope Repairs construction was AECOM Technical Services, Inc. (AECOM) located at 1001 Bishop Street, Suite 1600, Honolulu, Hawaii 96813.

All quality assurance activities performed by AECOM personnel were under the direct supervision of the Construction Quality Assurance (CQA) Officer or his designated representative, the CQA Monitor. The activities undertaken by AECOM are documented in the attached Construction Quality Assurance Letter Report for Cell E6 Sideslope Repairs, prepared by AECOM, dated April 2011. The monitoring, observation, and testing performed by and under the direction of AECOM have verified that Cell E6 Sideslope Repairs for the area indicated in this report were constructed in substantial conformance with the permit, approved project plans and specifications, construction quality assurance plan, and generally accepted construction practices.

The CQA Officer for this project was Mr. Ron Boyle. Additionally, Mr. Dan Braatz, and Dan Frerich were on-site serving as CQA Monitors. The CQA Officer assumes full responsibility for all CQA related activities performed by AECOM at this site whether under his direct supervision or at the direction of the CQA Monitor.

AECOM



Ron Boyle, P.E.
CQA Officer
Registered Professional Engineer
State of Hawaii No. 8431

Attachment 4
Daily Reports

Daily Field Report

AECOM

Site: Waimanalo Gulch Sanitary Landfill

Report Number: 8

Client: Waste Management of Hawaii

Date: 03/31/2011

Project: E-6 West Slope Repairs

Project No.: 60191059

Page 1 of 1

Temp (°F): Low 70 High 83

Wind Speed (mph): 15-20

Wind Direction: E/NE

Weather Conditions: Mostly Sunny, Windy

Contractor(s) on-site	No. of people
American Environmental Group	10
Goodfellow Bros., Inc. (GBI)	2

Equipment	No. on-site	No. in-use
Grandall Lift	2	2

Visitors	Representing
Ron Boyle	AECOM

Daily Notations:

Arrived on site at 7.00 am.
AEG and GBI crews working on the E-6 slope repair area by removing the damage liner and dressing up the subgrade for liner .
Around 10.00 am the remaining damage liner was removed and the subgrade was reworked and ready for liner.

AEG crew then started deploying the 40 mil HDPE liner and placed panels RS-10 to RS-16. Liner was deployed with the use of Grandall lift driven over geomembrane for GCL placement but maintaining a five foot buffer zone from the crest of the slope which is a no drive zone which will be used for future liner tie-in. The 40 mil liner look good with no visible damage from the Grandall driving on it
Trial welds TW-16 to TW-19 were constructed before and production seaming. All trial welds that were constructed met specifications.
Repairs R-60 to R-68 were constructed and passed vacuum testing.
All non destructive testing met specifications for field testing.
Destructive sample DS-5 and DS-6 were sampled and sent to the lab for testing. Samples were taken from 40/40 mil fusion seaming. See field data sheets for more detailed information on HDPE liner quality control assurance information.
Left site at 4.00 pm

Name: Dan Braatz

Signature:

Daily Field Report

AECOM

Site: Waimanalo Gulch Sanitary Landfill

Report Number: 9

Client: Waste Management of Hawaii

Date: 04/01/2011

Project: E-6 West Slope Repairs

Project No.: 60191059

Page 1 of 1

Temp (°F): Low 70 High 82

Wind Speed (mph): 15-20

Wind Direction: E/NE

Weather Conditions: Partly Cloudy, Windy, Sprinkles

Contractor(s) on-site	No. of people
American Environmental Group	10

Equipment	No. on-site	No. in-use
Grandall Lift	2	2

Visitors	Representing

Daily Notations:

Arrived on site at 7.00 am.

AEG crew deployed 60 mil HDPE liner and placed panels RP-14 to RP-21. Liner was deployed with the use of Grandall lift driven over GCL for liner placement but maintaining a five foot buffer zone from the crest of the slope which is a no drive zone which will be used for future liner tie-in. The 60 mil liner was not driven over.
Trial welds TW-20 to TW-23 were constructed before and production seaming. All trial welds that were constructed met specifications.
Repairs R-69 to R-84 were constructed and passed vacuum testing.
All non destructive testing met specifications for field testing.
See field data sheets for more detailed information on HDPE liner quality control assurance information.
16 oz geotextile was placed over the 60 mil HDPE liner that was placed this morning. Geotextile was seamed in a double payer method.
Repair area is completed and all destructive lab results has passed and met specifications.

Left repair area at 2.30 pm and went to cap area.

Name: Dan Braatz

Signature:

Attachment 5
Subgrade Acceptance Form

AECOM Technical Services, Inc.
1001 Bishop Street, Suite 1600
Honolulu, HI 96813-3698

Certificate of Acceptance of Soil Subgrade

Owner: _____

Project Name: WASTE MANAGEMENT OF HAWAII

Site Name: WAIMANALO GULCH SANITARY LANDFILL

Location: E-6 WEST SLOPE REPAIRS - NORTHERN

Date: 3-31-2011

Installer: AMERICAN ENVIRONMENTAL GROUP (AEG)

I the Undersigned, a duly authorized representative of AEG do hereby accept the Soil Subgrade surface covered by geomembrane panel(s) RS-10 to RS-16 as an acceptable surface on which to install geomembrane.

Ruben Ahlmirano | [signature] | Supervisor
Name | Signature | Title

3-31-2011
Date

AECOM's CQA certification acceptance by:

DAN BRAATZ | Dan Braatz | CQA
Name | Signature | Title

3-31-2011
Date

Attachment 6
Tensiometer Certificate

SYSTEM LOAD CALIBRATION CERTIFICATE

GSE Lining Technology, Inc.

19103 Gundle Road
Houston, Texas 77073
800-435-2008
281-443-8564
Fax: 281-875-6010

GSE Equipment Number	**OET-026**
Device	WEGENER
Display Instrument	# 015990
Load Cell Number	# 092758

GSE verifies the calibration of field testing equipment with a T-Hyronics TC-S-0-500 lb. load cell, serial number 228696, and a T-Hydronics 1028 transducer indicator, serial number 638, manufactured by T-Hydronics, Inc. of Westerville, Ohio. The transducer was compared to standards certified traceable to the National Institute of Standards and Technology, Washington, D. C. The most recent factory force transducer calibration for this device was August 20, 2009.

The calibration of the tensiometer, designated GSE equipment number **OET-026** was verified using the calibration load cell indicator described above on **April 26, 2010** . The reading of the calibrations are recorded as "true load".

True Load (lb.)	0	50	100	150	200	250	300	350	400	450	500
Display Load (Run #1)	0	50	100.2	150	200	250.2	300.5	350.2	400.1	450.2	500.4
Display Load (Run #2)	0	50	100.4	150.6	200.7	250.7	300.6	350.6	400.9	450.2	500.3
Display Load (Run #3)	0	50	100.3	150.2	200.4	250.3	300.3	350.4	400.5	450.3	500.2
Display Load (Average)	0	50	100.3	150.2	200.3	250.4	300.4	350.4	400.5	450.2	500.3

Wayne Leger
Field Services Manager

Tomas Duque
Utility Technician

Attachment 7
Geomembrane Installation Documentation

Attachment 7.1
Trial Welds Summary

TRIAL WELD SUMMARY

Waste Management of Hawaii
Waimanalo Gulch Sanitary Landfill
AECOM Project Number: 60191059
Project Name: E6 West Slope Repair

Weld Requirements

	40-mil		60-mil	
	Peel	Shear	Peel	Shear
Fusion:	60 ppi	80 ppi	91 ppi	120 ppi
Extrusion:	52 ppi	80 ppi	78 ppi	120 ppi

AECOM

Sample ID	Date	Time	Ambient Temp	Seamer ID	Machine ID	Extrusion Welds		Fusion Welds		Peel (ppi)	Shear (ppi)	Observer	Pass/Fail	Comments
						Barrel Temp	Preheat Temp	Wedge Temp	Wedge Speed					
TW-16	3/31/11	10.00	77	RC	2509	-	-	420	6.5	108/123	124	DTB	Pass	40/40
										107/113	121		Pass	
TWX-17	3/31/11	10.39	77	RB	1290	250	200	-	-	112	123	DTB	Pass	40/40
										111	122		Pass	
TWX-18	3/31/11	1.15	80	RB	1290	250	200	-	-	109	116	DTB	Pass	40/40
										109	116		Pass	
TW-19	3/31/11	12.55	80	RC	2509	-	-	420	7.0	109/107	116	DTB	Pass	40/40
										107/119	119		Pass	
TW-20	4/1/11	7.30	74	RC	2509	-	-	450	5.0	144/145	187	DTB	Pass	60/60
										141/148	184		Pass	
TWX-21	4/1/11	7.40	74	RB	1290	250	200	-	-	83	179	DTB	Pass	60/60
										129	180		Pass	
TWX-22	4/1/11	7.45	74	RB	1290	250	200	-	-	109	142	DTB	Pass	40/60
										129	145		Pass	
TWX-23	4/1/11	10.08	78	RC	3967	250	240	-	-	105	110	DTB	Pass	40/60
										107	108		Pass	

Notes:

DTB	Dan Braatz (AECOM)
ppi	pounds per inch
Temp	temperature (degrees Fahrenheit)
TW	Trial weld-fusion
TWX	Trial weld-extrusion

Attachment 7.2
Panel Placement Summary

PANEL PLACEMENT SUMMARY

Waste Management of Hawaii
Waimanalo Gulch Sanitary Landfill
AECOM Project Number: 60191059
Project Name: E6 West Slope Repairs

AECOM

Date	Layer	Panel Number	Location	Roll Number	Panel Length (feet)	Station		Observer	Comments/Damage
						Beg.	End		
3/31/2011	S	RS-10	Northern Repair Area	1734	45	0+00	0+45	DTB	
3/31/2011	S	RS-11	Northern Repair Area	1734	45	0+00	0+45	DTB	
3/31/2011	S	RS-12	Northern Repair Area	1734	42	0+00	0+42	DTB	
3/31/2011	S	RS-13	Northern Repair Area	1734	42	0+00	0+42	DTB	
3/31/2011	S	RS-14	Northern Repair Area	1734	42	0+00	0+42	DTB	
3/31/2011	S	RS-15	Northern Repair Area	1734	39	0+00	0+39	DTB	
3/31/2011	S	RS-16	Northern Repair Area	1734	34	0+00	0+34	DTB	
4/1/2011	P	RP-14	Northern Repair Area	1592	47	0+00	0+47	DTB	
4/1/2011	P	RP-15	Northern Repair Area	1592	47	0+00	0+47	DTB	
4/1/2011	P	RP-16	Northern Repair Area	1592	46	0+00	0+46	DTB	
4/1/2011	P	RP-17	Northern Repair Area	1592	43	0+00	0+43	DTB	
4/1/2011	P	RP-18	Northern Repair Area	1592	43	0+00	0+43	DTB	
4/1/2011	P	RP-19	Northern Repair Area	1592	43	0+00	0+43	DTB	
4/1/2011	P	RP-20	Northern Repair Area	1592	39	0+00	0+39	DTB	
4/1/2011	P	RP-21	Northern Repair Area	1592	34	0+00	0+34	DTB	

Notes:

DTB	Dan Braatz, AECOM
P	P layer 60-mil panel of single composite liner system in northern repair area
RP	Repair panel of P2 layer 60-mil panel number of double composite liner system in southern repair area and the P layer 60-mil panel number of single composite liner system in northern repair area
RS	Repair panel of S layer 40-mil panel number of single composite liner system in northern repair area
S	S layer 40-mil panel of single composite liner system in northern repair area

Attachment 7.3
Panel Seaming Summary

PANEL SEAMING SUMMARY

Waste Management of Hawaii
Waimanalo Gulch Sanitary Landfill
AECOM Project Number: 60191059
Project Name: E6 West Slope Repairs

AECOM

Seam ID		Date	Start Time	Seam Location	Seamer ID	Machine ID	Station		Seam Length	Observer	Comments
							Beg.	End			
RS-10	RS-1	3/31/2011	10:22	Northern Repair Area	RC	2509	0+00	0+44	44	DTB	40 mil repair panels
RS-10	RS-11	3/31/2011	10:46	Northern Repair Area	RC	2509	0+00	0+45	45	DTB	40 mil repair panels
RS-11	RS-12	3/31/2011	10:56	Northern Repair Area	RC	2509	0+00	0+42	42	DTB	40 mil repair panels
RS-12	RS-13	3/31/2011	11:10	Northern Repair Area	RC	2509	0+00	0+42	42	DTB	40 mil repair panels
RS-1	Tie-in	3/31/2011	11:11	Northern Repair Area	RB	1290	5+06	5+00	6	DTB	40 mil repair panels
RS-1	Tie-in	3/28/2011	4:19	Northern Repair Area	RB	1290	5+06	5+22	16	DTB	40 mil repair panels
RS-10	Tie-in	3/31/2011	11:23	Northern Repair Area	RB	1290	5+00	4+78	22	DTB	40 mil repair panels
RS-11	Tie-in	3/31/2011	11:33	Northern Repair Area	RB	1290	4+78	4+56	22	DTB	40 mil repair panels
RS-12	Tie-in	3/31/2011	11:43	Northern Repair Area	RB	1290	4+56	4+34	22	DTB	40 mil repair panels
RS-13	Tie-in	3/31/2011	1:06	Northern Repair Area	RB	1290	4+34	4+12	22	DTB	40 mil repair panels
RS-14	Tie-in	3/31/2011	1:26	Northern Repair Area	RB	1290	4+12	3+90	22	DTB	40 mil repair panels
RS-15	Tie-in	3/31/2011	1:36	Northern Repair Area	RB	1290	3+90	3+68	22	DTB	40 mil repair panels
RS-16	Tie-in	3/31/2011	2:03	Northern Repair Area	RB	1290	3+68	3+46	22	DTB	40 mil repair panels
RS-13	RS-14	3/31/2011	1:00	Northern Repair Area	RC	2509	0+00	0+42	42	DTB	40 mil repair panels
RS-14	RS-15	3/31/2011	1:15	Northern Repair Area	RC	2509	0+00	0+39	39	DTB	40 mil repair panels
RS-15	RS-16	3/31/2011	1:33	Northern Repair Area	RC	2509	0+00	0+34	34	DTB	40 mil repair panels
RP-13	RP-14	4/1/2011	7:50	Northern Repair Area	RC	2509	0+00	0+46	46	DTB	60 mil repair panels
RP-14	RP-15	4/1/2011	8:30	Northern Repair Area	RC	2509	0+00	0+47	47	DTB	60 mil repair panels
RP-15	RP-16	4/1/2011	8:34	Northern Repair Area	RC	2509	0+00	0+46	46	DTB	60 mil repair panels
RP-16	RP-17	4/1/2011	9:00	Northern Repair Area	RC	2509	0+00	0+43	43	DTB	60 mil repair panels
RP-17	RP-18	4/1/2011	9:05	Northern Repair Area	RC	2509	0+00	0+43	43	DTB	60 mil repair panels
RP-18	RP-19	4/1/2011	9:20	Northern Repair Area	RC	2509	0+00	0+43	43	DTB	60 mil repair panels
RP-19	RP-20	4/1/2011	9:33	Northern Repair Area	RC	2509	0+00	0+39	39	DTB	60 mil repair panels
RP-20	RP-21	4/1/2011	9:40	Northern Repair Area	RC	2509	0+00	0+34	34	DTB	60 mil repair panels
RP-13	Tie-in	4/1/2011	8:00	Northern Repair Area	RC	2509	5+36	5+22	14	DTB	60 mil repair panels
RP-14	Tie-in	4/1/2011	8:24	Northern Repair Area	RC	2509	5+22	5+00	22	DTB	60 mil repair panels
RP-15	Tie-in	4/1/2011	9:00	Northern Repair Area	RC	2509	5+00	4+78	22	DTB	60 mil repair panels

PANEL SEAMING SUMMARY

Waste Management of Hawaii
Waimanalo Gulch Sanitary Landfill
AECOM Project Number: 60191059
Project Name: E6 West Slope Repairs

AECOM

Seam ID			Date	Start Time	Seam Location	Seamer ID	Machine ID	Station		Seam Length	Observer	Comments
								Beg.	End			
RP-16		Tie-in	4/1/2011	9:20	Northern Repair Area	RC	2509	4+78	4+56	22	DTB	60 mil repair panels
RP-17		Tie-in	4/1/2011	9:40	Northern Repair Area	RC	2509	4+56	4+34	22	DTB	60 mil repair panels
RP-18		Tie-in	4/1/2011	9:48	Northern Repair Area	RB	1290	4+34	4+12	22	DTB	60 mil repair panels
RP-19		Tie-in	4/1/2011	9:58	Northern Repair Area	RB	1290	4+12	3+90	22	DTB	60 mil repair panels
RP-20		Tie-in	4/1/2011	10:10	Northern Repair Area	RB	1290	3+90	3+68	22	DTB	60 mil repair panels
RP-21		Tie-in	4/1/2011	10:20	Northern Repair Area	RB	1290	3+68	3+49	19	DTB	60 mil repair panels
RP-21		RS-16	4/1/2011	10:51	Northern Repair Area	RB	1290	0+00	0+32	32	DTB	40/60 Encapsulation
RP-21		RS-16	4/1/2011	10:45	Northern Repair Area	RC	3967	3+49	3+68	19	DTB	40/60 Encapsulation
RP-20		RS-16	4/1/2011	10:50	Northern Repair Area	RC	3967	3+68	3+70	2	DTB	40/60 Encapsulation
RP-20		RS-15	4/1/2011	10:54	Northern Repair Area	RC	3967	3+70	3+90	20	DTB	40/60 Encapsulation
RP-19		RS-15	4/1/2011	11:00	Northern Repair Area	RC	3967	3+90	3+92	2	DTB	40/60 Encapsulation
RP-19		RS-14	4/1/2011	11:05	Northern Repair Area	RC	3967	3+92	4+12	20	DTB	40/60 Encapsulation
RP-18		RS-14	4/1/2011	11:10	Northern Repair Area	RC	3967	4+12	4+14	2	DTB	40/60 Encapsulation
RP-18		RS-13	4/1/2011	11:12	Northern Repair Area	RC	3967	4+14	4+34	20	DTB	40/60 Encapsulation
RP-17		RS-13	4/1/2011	11:17	Northern Repair Area	RC	3967	4+34	4+35	1	DTB	40/60 Encapsulation
RP-17		RS-12	4/1/2011	11:19	Northern Repair Area	RC	3967	4+35	4+56	21	DTB	40/60 Encapsulation
RP-16		RS-12	4/1/2011	11:25	Northern Repair Area	RC	3967	4+56	4+57	1	DTB	40/60 Encapsulation
RP-16		RS-11	4/1/2011	11:26	Northern Repair Area	RC	3967	4+57	4+78	21	DTB	40/60 Encapsulation
RP-15		RS-11	4/1/2011	11:30	Northern Repair Area	RC	3967	4+78	4+79	1	DTB	40/60 Encapsulation
RP-15		RS-10	4/1/2011	11:31	Northern Repair Area	RC	3967	4+79	5+00	21	DTB	40/60 Encapsulation
RP-14		RS-10	4/1/2011	11:37	Northern Repair Area	RC	3967	5+00	5+01	1	DTB	40/60 Encapsulation
RP-14		RS-1	4/1/2011	11:38	Northern Repair Area	RC	3967	5+01	5+22	21	DTB	40/60 Encapsulation

Notes:

RP-# Repair panel of P layer 60-mil panel number of single composite liner system in northern repair area

RS-# Repair panel of S layer 40-mil panel number of single composite liner system in northern repair area

Tie-in Tie-in-in to undamaged existing Cell E6 panels

Attachment 7.4
Non-Destructive Seam Testing Summary

NON-DESTRUCTIVE SEAM TESTING SUMMARY

Waste Management of Hawaii
Waimanalo Gulch Sanitary Landfill
AECOM Project Number: 60191059
Project Name: E6 West Slope Repairs

Seam Requirements
Pressurize To: 30 psi Max Allowable Pressure Drop: 2 psi after 2 min relaxing period and 5 min test

Seam ID		Date	Seam Location	Station		Test	Air Testing					Vacuum Test	Observer	Comments
							Time		Pressure		Results			
				Beg	End	Crew	Beg.	End	Beg.	End	P/F	P/F		
RS-10	RS-1	03/31/11	Northern Repair Area	0+00	0+44	BC	10:35	10:40	30	30	P	-	DTB	
RS-10	RS-11	03/31/11	Northern Repair Area	0+00	0+15	BC	10:34	10:39	30	30	P	-	DTB	
RS-10	RS-11	03/31/11	Northern Repair Area	0+20	0+45	BC	10:55	11:00	30	30	P	-	DTB	
RS-11	RS-12	03/31/11	Northern Repair Area	0+00	0+42	JRG	11:08	11:13	30	30	P	-	DTB	
RS-12	RS-13	03/31/11	Northern Repair Area	0+00	0+42	JRG	11:23	11:28	30	30	P	-	DTB	
RS-1	Tie-in	03/31/11	Northern Repair Area	5+06	5+00	OL	-	-	-	-	-	P	DTB	
RS-1	Tie-in	03/28/11	Northern Repair Area	5+06	5+22	OL	-	-	-	-	-	P	DTB	
RS-10	Tie-in	03/31/11	Northern Repair Area	5+00	4+78	OL	-	-	-	-	-	P	DTB	
RS-11	Tie-in	03/31/11	Northern Repair Area	4+78	4+56	OL	-	-	-	-	-	P	DTB	
RS-12	Tie-in	03/31/11	Northern Repair Area	4+56	4+34	OL	-	-	-	-	-	P	DTB	
RS-13	Tie-in	03/31/11	Northern Repair Area	4+34	4+12	OL	1:16	1:21	30	30	P	-	DTB	
RS-13	RS-14	03/31/11	Northern Repair Area	0+00	0+42	JRG	1:25	1:30	30	30	P	-	DTB	
RS-14	RS-15	03/31/11	Northern Repair Area	0+00	0+39	JRG	1:40	1:45	30	30	P	-	DTB	
RS-15	RS-16	03/31/11	Northern Repair Area	0+00	0+34	JRG	-	-	-	-	-	P	DTB	
RS-14	Tie-in	03/31/11	Northern Repair Area	4+12	3+90	OL	-	-	-	-	-	P	DTB	
RS-15	Tie-in	03/31/11	Northern Repair Area	3+90	3+68	OL	-	-	-	-	-	P	DTB	
RS-16	Tie-in	03/31/11	Northern Repair Area	3+68	3+46	OL	-	-	-	-	-	P	DTB	
RP-13	RP-14	04/01/11	Northern Repair Area	0+00	0+46	BC	8:30	8:35	30	30	P	-	DTB	
RP-14	RP-15	04/01/11	Northern Repair Area	0+00	0+47	BC	8:40	8:45	30	29	P	-	DTB	
RP-15	RP-16	04/01/11	Northern Repair Area	0+00	0+46	BC	8:48	8:53	30	30	P	-	DTB	
RP-16	RP-17	04/01/11	Northern Repair Area	0+00	0+43	BC	9:00	9:05	30	30	P	-	DTB	

NON-DESTRUCTIVE SEAM TESTING SUMMARY

Waste Management of Hawaii
Waimanalo Gulch Sanitary Landfill
AECOM Project Number: 60191059
Project Name: E6 West Slope Repairs

Seam Requirements
Pressurize To: 30 psi Max Allowable Pressure Drop: 2 psi after 2 min relaxing period and 5 min test

Seam ID		Date	Seam Location	Station Beg	Station End	Test Crew	Air Testing Time Beg.	Air Testing Time End	Air Testing Pressure Beg.	Air Testing Pressure End	Air Testing Results P/F	Vacuum Test P/F	Observer	Comments
RP-17	RP-18	04/01/11	Northern Repair Area	0+00	0+43	OL	9:18	9:23	30	30	P	-	DTB	
RP-18	RP-19	04/01/11	Northern Repair Area	0+00	0+43	OL	9:30	9:35	30	30	P	-	DTB	
RP-19	RP-20	04/01/11	Northern Repair Area	0+00	0+39	OL	9:37	9:42	30	30	P	-	DTB	
RP-20	RP-21	04/01/11	Northern Repair Area	0+00	0+34	OL	9:45	9:50	30	30	P	-	DTB	
RP-13	Tie-in	04/01/11	Northern Repair Area	5+36	5+22	JRG	-	-	-	-	-	P	DTB	
RP-14	Tie-in	04/01/11	Northern Repair Area	5+22	5+00	JRG	-	-	-	-	-	P	DTB	
RP-15	Tie-in	04/01/11	Northern Repair Area	5+00	4+78	JRG	-	-	-	-	-	P	DTB	
RP-16	Tie-in	04/01/11	Northern Repair Area	4+78	4+56	JRG	-	-	-	-	-	P	DTB	
RP-17	Tie-in	04/01/11	Northern Repair Area	4+56	4+34	JRG	-	-	-	-	-	P	DTB	
RP-18	Tie-in	04/01/11	Northern Repair Area	4+34	4+12	JRG	-	-	-	-	-	P	DTB	
RP-19	Tie-in	04/01/11	Northern Repair Area	4+12	0	JRG	-	-	-	-	-	P	DTB	
RP-20	Tie-in	04/01/11	Northern Repair Area	3+90	3+68	JRG	-	-	-	-	-	P	DTB	
RP-21	Tie-in	04/01/11	Northern Repair Area	3+68	3+49	JRG	-	-	-	-	-	P	DTB	
RP-21	RS-16	04/01/11	Northern Repair Area	0+00	0+32	JRG	-	-	-	-	-	P	DTB	40/60 Encapsulation
RP-21	RS-16	04/01/11	Northern Repair Area	3+49	3+68	JRG	-	-	-	-	-	P	DTB	40/60 Encapsulation
RP-20	RS-16	04/01/11	Northern Repair Area	3+68	3+70	JRG	-	-	-	-	-	P	DTB	40/60 Encapsulation
RP-20	RS-15	04/01/11	Northern Repair Area	3+70	3+90	JRG	-	-	-	-	-	P	DTB	40/60 Encapsulation
RP-19	RS-15	04/01/11	Northern Repair Area	3+90	3+92	JRG	-	-	-	-	-	P	DTB	40/60 Encapsulation
RP-19	RS-14	04/01/11	Northern Repair Area	3+92	4+12	JRG	-	-	-	-	-	P	DTB	40/60 Encapsulation
RP-18	RS-14	04/01/11	Northern Repair Area	4+12	4+14	JRG	-	-	-	-	-	P	DTB	40/60 Encapsulation
RP-18	RS-13	04/01/11	Northern Repair Area	4+14	4+34	JRG	-	-	-	-	-	P	DTB	40/60 Encapsulation

NON-DESTRUCTIVE SEAM TESTING SUMMARY

Waste Management of Hawaii
Waimanalo Gulch Sanitary Landfill
AECOM Project Number: 60191059
Project Name: E6 West Slope Repairs

AECOM

Seam Requirements
Pressurize To: 30 psi Max Allowable Pressure Drop: 2 psi after 2 min relaxing period and 5 min test

Seam ID		Date	Seam Location	Station Beg	Station End	Test Crew	Air Testing Time Beg.	Air Testing Time End	Air Testing Pressure Beg.	Air Testing Pressure End	Air Testing Results P/F	Vacuum Test P/F	Observer	Comments
RP-17	RS-13	04/01/11	Northern Repair Area	4+34	4+35	JRG	-	-	-	-	-	P	DTB	40/60 Encapsulation
RP-17	RS-12	04/01/11	Northern Repair Area	4+35	4+56	JRG	-	-	-	-	-	P	DTB	40/60 Encapsulation
RP-16	RS-12	04/01/11	Northern Repair Area	4+56	4+57	JRG	-	-	-	-	-	P	DTB	40/60 Encapsulation
RP-16	RS-11	04/01/11	Northern Repair Area	4+57	4+78	JRG	-	-	-	-	-	P	DTB	40/60 Encapsulation
RP-15	RS-11	04/01/11	Northern Repair Area	4+78	4+79	JRG	-	-	-	-	-	P	DTB	40/60 Encapsulation
RP-15	RS-10	04/01/11	Northern Repair Area	4+79	5+00	JRG	-	-	-	-	-	P	DTB	40/60 Encapsulation
RP-14	RS-10	04/01/11	Northern Repair Area	5+00	5+01	JRG	-	-	-	-	-	P	DTB	40/60 Encapsulation
RP-14	RS-1	04/01/11	Northern Repair Area	5+01	5+22	JRG	-	-	-	-	-	P	DTB	40/60 Encapsulation

Notes:

DTB	Dan Braatz, AECOM
P	Pass
RP	Repair panel of the P layer 60-mil panel number of single composite liner system in northern repair area
RS	Repair panel of the S layer 40-mil panel number of single composite liner system in northern repair area
Tie-in	Tie-in to undamaged existing Cell E6 panels

Attachment 7.5
Destructive Seam Log and Testing Summary

DESTRUCTIVE SEAM LOG AND TESTING SUMMARY

Waste Management of Hawaii
Waimanalo Gulch Sanitary Landfill
AECOM Project Number: 60191059
Project Name: E-6 West Slope Repairs

Weld Requirements

	40-mil		60-mil	
	Peel	Shear	Peel	Shear
Fusion:	60 ppi	80 ppi	91 ppi	120 ppi
Extrusion:	52 ppi	80 ppi	78 ppi	120 ppi

Sample Number	Date Sampled	Seamer ID	Machine ID	Seam ID	Location	Field Test Pass/Fail	Weld Type Extrusion/ Fusion	Peel		Shear		Lab Test Pass/Fail
								ppi	Failure Mode	ppi	Failure Mode	
DS-05	03/30/11	RC	2509	RS-10/RS-11	0+10	Pass	Fusion	101/96	FTB	130	FTB	Pass
								102/102	FTB	127	FTB	
								103/102	FTB	126	FTB	
								98/103	FTB	128	FTB	
								98/104	FTB	128	FTB	
DS-06	03/03/11	RC	2509	RS-12/RS-13	0+10	Pass	Fusion	103/100	FTB	131	FTB	Pass
								102/98	FTB	129	FTB	
								102/98	FTB	125	FTB	
								103/104	FTB	130	FTB	
								104/102	FTB	130	FTB	

Notes:
FTB film tear bond
ppi pounds per inch
psi pounds per square inch
RS Repair panel of S layer 40-mil panel number of single composite liner system in northern repair area

Attachment 7.6
Geomembrane Repair Summary

GEOMEMBRANE REPAIR SUMMARY

Waste Management of Hawaii
Waimanalo Gulch Sanitary Landfill
AECOM Project Number: 60191059
Project Name: E6 West Slope Repairs

AECOM

Repair Number	Date Repaired	Seam ID			Panel (s)	Location	Description of Damage	Type/Size of Repair	Repair Crew	Date Tested	Tested By	Observer	Comments
60	3/31/2011	RS-1	RS-10			5+00	Tee	3 x 3	RB	3/31/2011	OL	DTB	40 mil
61	3/31/2011	RS-10	RS-11			4+78	Tee	2 x 2	RB	3/31/2011	OL	DTB	40 mil
62	3/31/2011	RS-11	RS-12			4+56	Tee	3 x 3	RB	3/31/2011	OL	DTB	40 mil
63	3/31/2011	RS-12	RS-13			4+34	Tee	2 x 3	RB	3/31/2011	OL	DTB	40 mil
64	3/31/2011	RS-13	RS-14			4+12	Tee	2 x 2	RB	3/31/2011	OL	DTB	40 mil
65	3/31/2011	RS-14	RS-15			3+90	Tee	2 x 2	RB	3/31/2011	OL	DTB	40 mil
66	3/31/2011	RS-15	RS-16			3+68	Tee	2 x 3	RB	3/31/2011	OL	DTB	40 mil
67	3/31/2011	RS-12	RS-13			4+34	DS-6	2 x 4	RB	3/31/2011	OL	DTB	40 mil
68	3/31/2011	RS-10	RS-11			4+78	DS-5	2 x 11	RB	3/31/2011	OL	DTB	40 mil
69	4/1/2011	RP-13	RP-14	Tie-in		5+22	Tee	2 x 2	RB	4/1/2011	JRG	DTB	60 mil
70	4/1/2011	RP-14	Tie-in			5+14	Tee	2 x 2	RB	4/1/2011	JRG	DTB	60 mil
71	4/1/2011	RP-14	RP-15	Tie-in		5+00	Tee	2 x 2	RB	4/1/2011	JRG	DTB	60 mil
72	4/1/2011	RP-15	Tie-in			4+92	Tee	2 x 2	RB	4/1/2011	JRG	DTB	60 mil
73	4/1/2011	RP-15	RP-16	Tie-in		4+78	Tee	2 x 2	RB	4/1/2011	JRG	DTB	60 mil
74	4/1/2011	RP-16	Tie-in			4+70	Tee	2 x 2	RB	4/1/2011	JRG	DTB	60 mil
75	4/1/2011	RP-16	RP-17	Tie-in		4+56	Tee	2 x 2	RB	4/1/2011	JRG	DTB	60 mil
76	4/1/2011	RP-17	Tie-in			4+48	Tee	1 x 1	RB	4/1/2011	JRG	DTB	60 mil
77	4/1/2011	RP-17	RP-18	Tie-in		4+34	Tee	2 x 2	RB	4/1/2011	JRG	DTB	60 mil
78	4/1/2011	RP-18	Tie-in			4+26	Tee	1 x 1	RB	4/1/2011	JRG	DTB	60 mil
79	4/1/2011	RP-18	RP-19	Tie-in		4+12	Tee	2 x 2	RB	4/1/2011	JRG	DTB	60 mil
80	4/1/2011	RP-19	Tie-in			4+04	Tee	2 x 2	RB	4/1/2011	JRG	DTB	60 mil

GEOMEMBRANE REPAIR SUMMARY

Waste Management of Hawaii
Waimanalo Gulch Sanitary Landfill
AECOM Project Number: 60191059
Project Name: E6 West Slope Repairs

AECOM

Repair Number	Date Repaired	Seam ID			Panel (s)	Location	Description of Damage	Type/Size of Repair	Repair Crew	Date Tested	Tested By	Observer	Comments
81	4/1/2011	RP-19	RP-20	Tie-in		3+90	Tee	1 x 1	RB	4/1/2011	JRG	DTB	60 mil
82	4/1/2011	RP-20	Tie-in			3+82	Tee	1 x 1	RB	4/1/2011	JRG	DTB	60 mil
83	4/1/2011	RP-20	RP-21	Tie-in		3+68	Tee	1 x 1	RB	4/1/2011	JRG	DTB	60 mil
84	4/1/2011	RP-21	Tie-in			3+60	Tee	1 x 1	RB	4/1/2011	JRG	DTB	60 mil

Notes

DS-#	Destructive seam test location
DTB	Dan Braatz, AECOM
RP	Repair panel of P2 layer 60-mil panel number of double composite liner system in southern repair area and the P layer 60-mil panel number of single composite liner system in northern repair area
RS	Repair panel of S layer 40-mil panel number of single composite liner system in northern repair area
Tie-in	Tie-in-in to undamaged existing Cell E6 panels

Attachment 7.7
Destructive Seam Laboratory Data

Precision Geosynthetic Laboratories International

GAI-LAP
Initial: CVZ #:0.13
DATE: 04/01/2011

Ron Boyle
AECOM
1001 Bishop Street, Suite 1600
Honolulu, HI 96813

Dear Mr. Boyle:

Thank you for consulting Precision Geosynthetic Laboratories International (PGLI) for your material testing needs.

Enclosed is the ***final*** laboratory report for the seam testing of two (2) 40mil HDPE Seam samples.

PROJECT NAME: Waimanalo Gulch Sanitary Landfill Phase 3 E6 West Slope Repairs/ **Project No.** 60191059

REFERENCE PGL JOB NO.: G110248

DATE RECEIVED: April 1, 2011 **DATE REPORTED:** April 1, 2011

SAMPLES SENT BY: Dan Frerich, AECOM

SAMPLE IDENTIFICATIONS:

SAMPLE ID	PGLI CONTROL NUMBER
DS- 5 RS-10/RS-11 STA 0+10 RC 2509	71328
DS- 6 RS-12/RS-13 STA 0+10 RC 2509	71329

TESTS REQUIRED/PERFORMED:

TEST METHOD	DESCRIPTION
ASTM D6392	Shear Bond Strength
ASTM D6392	Peel Bond Adhesion

TEST CONDITIONS: The samples were conditioned for a minimum of one hour in the laboratory at 22 ± 2°C (71.6 ± 3.6°F) and at 60 ± 10% relative humidity prior to test.

TEST RESULTS: The test results are summarized in Table 1.

PRECISION GEOSYNTHETIC LABORATORIES INTERNATIONAL

Maria Espitia
Quality Assurance

Carmelo V. Zantua
Technical/Laboratory Director

It shall be noted that the samples tested are believed to be true representatives of the material produced under the designation herein stated. In addition, the attached laboratory tests results are considered indicative only of the quality of samples/specimens that were actually tested. The appropriate test methods hereby employed are based on the current and accepted industry practices. Precision Geosynthetic Laboratories neither accepts responsibility for nor makes claims to the intended final use and purpose of the material. The test data and all associated project information shall be held confidential and not to be reproduced and/or disclosed to other parties except in full and with prior written approval from pertinent entity duly authorized by the respective client or from the client itself. It is a policy of the company to keep physical records of each job for two (2) years commencing from the date of receipt of the samples and keep its corresponding electronic file for seven (7) years. ***Failed seam samples are kept for two (2) years and good seam samples are disposed of after two (2) weeks.*** On the other hand, should you need us to keep them at longer time, please advise us in writing.

WMH007315

TABLE 1.
SEAM PEEL AND SHEAR TEST RESULTS

CLIENT: **AECOM**
PROJECT: **Waimanalo Gulch Sanitary Landfill Phase 3**
E6 West Slope Repairs/ Project No. 60191059
DATE REC'D: **1-Apr-11**

MATERIAL: **40mil HDPE SEAM**
SEAM TYPE: **Fusion Weld**
PGL JOB #: **G110248**

QC'd By: Maria Espitia
TEST METHOD: ASTM D6392
DATE REPORT: 1-Apr-11

Crosshead Speed: 2 in/min		SHEAR EVALUATION				Crosshead Speed: 2 in/min	PEEL EVALUATION			
SAMPLE ID	PGL CONTROL #	MAXIMUM STRENGTH (lb/in width)	% Elongation	Locus of Break	PROJECT SPEC. (lb/in width)	SPECIMEN NUMBER	MAXIMUM STRENGTH (lb/in width)	% INCURSION (%)	LOCUS OF BREAK	PROJECT SPEC. (lb/in width)
DS-5	**71328**	130	> 50%	BRK		1 Outside	101	0	SE1	
RS-10/RS11		127	> 50%	BRK		2 Outside	102	0	SE1	
STA 0+10		126	> 50%	BRK		3 Outside	103	0	SE1	
RC 2509		128	> 50%	BRK		4 Outside	98	0	SE1	
		128	> 50%	BRK		5 Outside	98	0	SE1	
						AVG:	**100**			60
						STD. DEV.	**2**			
						1 Inside	96	0	SE1	
						2 Inside	102	0	SE1	
						3 Inside	102	0	SE1	
						4 Inside	103	0	SE1	
						5 Inside	104	0	SE1	
	AVG.	**128**			80	**AVG:**	**101**			60
	STD. DEV.	**1**				STD. DEV.	**3**			
DS-6	**71329**	131	> 50%	BRK		1 Outside	103	0	SE1	
RS-12/ RS-13		129	> 50%	BRK		2 Outside	102	0	SE1	
STA 0+10		125	> 50%	BRK		3 Outside	102	0	SE1	
RC 2509		130	> 50%	BRK		4 Outside	103	0	SE1	
		130	> 50%	BRK		5 Outside	104	0	SE1	
						AVG:	**103**			60
						STD. DEV.	**1**			
						1 Inside	100	0	SE1	
						2 Inside	98	0	SE1	
						3 Inside	98	0	SE1	
						4 Inside	104	0	SE1	
						5 Inside	102	0	SE1	
	AVG:	**129**			80	**AVG:**	**100**			60
	STD. DEV.	**2**				STD. DEV.	**3**			

BREAK DESCRIPTION (ASTM D6392 FUSION):

AD	ADHESION FAILURE.
BRK	BREAK IN SHEETING.
SE1	BREAK AT OUTER EDGE OF SEAM.
SE2	BREAK AT INNER EDGE OF SEAM.
AD-BRK	BREAK IN FIRST SEAM AFTER SOME ADHESION FAILURE.
SIP	SEPARATION IN THE PLANE OF THE SHEET.

EXTRUSION:

AD1	ADHESION FAILURE. SPECIMENS DELAMINATED UNDER THE BEAD.
AD2	ADHESION FAILURE.
AD-WLD	BREAK THROUGH THE FILLET.
SE1	BREAK AT BOTTOM EDGE OF SEAM.
SE2	BREAK AT TOP EDGE OF SEAM.
SE3	BREAK AT BOTTOM EDGE OF SEAM (for PEEL only)
BRK1	BREAK IN BOTTOM SHEETING.
BRK2	BREAK IN TOP SHEETING.
AD-BRK	BREAK IN FIRST SEAM AFTER SOME ADHESION FAILURE.
HT	BREAK AT EDGE OF HOT TACK
SIP	SEPARATION IN THE PLANE OF THE SHEET.

Attachment 8
Field Revisions

Document 00660
REQUEST FOR INFORMATION (RFI)

CONTRACTOR'S REQUEST

RFI Date: 5/8/10 RFI No. 026- GCL Overlap

Drawing No. N/A Specification No. 02777, 3.05 (A)

Date Information Required: 5/10/10

Information Required: Specification Section 02777, 3.05, (A) states that "On slopes steeper than 10 horizontal to 1 vertical, all geosynthetic clay liners shall be continuous down the slope; that is, no horizontal seams shall be allowed on the slope."

Currently for the Phase II West Berm Cap and the West Berm Buttress Cap areas, the slope areas are longer than the GCL roll lengths in some areas. The new rolls that were ordered are 150 feet in length whereas the slopes have lengths in some areas are greater than 190 feet. In past projects at WGSL where this situation was encountered, an overlap of 5 feet and gluing with 3M Super 77 glue, as recommended by the manufacturer, was allowed for horizontal cross seams.

Please confirm if this method can be used.

By: Ron Boyle Date: 5/8/10

Title: CQA Officer

OWNER'S RESPONSE

The proposed method is accepted. **In addition**, the procedures and requirements outlined on Page 0660-1B shall be followed to apply 3M Super 77 glue.

By: F. Settepani Date: 10 May 2010

Title: Sr. Eng./Geosyntec Consultants, Inc.

Waimanalo Gulch Landfill

Adhesive Application Procedures for Geosynthetic Clay Liner (GCL)

As used previously, the following procedure shall be used for each geosynthetic clay liner (GCL) seam:

- Overlap the upper GCL panel over the lower GCL panel by 5-ft.
- Fold back the upper GCL panel to expose the underside of the upper GCL panel.
- Uniformly apply 3M-Super 77 adhesive in the area between 6 and 18 inches (i.e., 1-foot-wide) along the entire width of both the upper and lower GCL panels. That is: leave the area between 0 and 6 inches from the edge along the entire width of the upper and lower panels unglued.
- On both panels, cover the entire width of the 12-inch-wide surface area of the seam with adhesive.
- Lay the upper GCL panel on top of the lower GCL panel and press both panels together by hand; use a roller to apply additional bonding pressure.

Other Requirements

In addition to the procedures described above, other requirements are:

- Limit the adhesive-bonded seams to the lower end (lower 20%) of a sideslope length.
- Stagger bonded seams at least 5 feet (bottom of one overlap to the top of adjacent overlap) so that there are no continuous seams across multiple GCL panels.
- Shingle the overlapping panels so that the upslope GCL panel is over the top of downslope panel. At the exposed panel end, the geotextile backing of the upslope panel shall be heat bonded to geotextile backing of the underlying GCL to help contain the bentonite placed along the end.

CONTRACTOR'S RESPONSE

This clarification will result in no increase in Contract Price or Contract Time. ___ Concur ___ Do Not Concur

Comments: _____

_____

By:_____ Date:_____

Title:_____

END OF DOCUMENT